Not only computing – also art

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It's impossible

Dr Chris French of UMIST has taken me to task for saying in the last issue, when I discussed the book *Hypergraphics,* that the so-called 'impossible triangles' could not be built in three-dimensions. He points that the original Penrose and Penrose 1958 article, which first described such objects, actually showed a picture of a three-dimensional version and that R. L. Gregory's, more accessible, 1970 book *The Intelligent Eye,* also shows one. Now these facts were known to me when I wrote my piece. Indeed, I had not only seen photographs of models of the objects but also the models themselves, and had even made some myself soon after reading the Penrose article in the late 1950s. However, it seemed to me that what I was doing then was simulating in three-dimensions the appearance of the drawing, rather than making the object that the drawing purported to be. I can illustrate this distinction by saying that, all over Milan, souvenir shops sell at least two versions of Leonardo's 'Last Supper'; a small copy of the painting itself and a plastic or metal plaque of it in low-relief and 'built-in' exaggerated perspective. Both these objects purport to be visual descriptions of a real room in which real people sit at a real table. The artist invites us to believe that we could walk around such a room, examining utensils on the table, passing behind the figures and seeing the walls beyond. The room would hold no surprises; it would be real in the sense that the room in which I am now sitting is real. We could make a life-size version of it and people it with figures, as has been done many times for biblical films. The picture and the plaque, however, are not the room but are representations of it – analogues: one in two-dimensions, the other in three. Similarly, the Penrose drawing and model are two- and three-dimensional analogues of the impossible triangle. They are simply different ways of illustrating the illusion. Even Gregory says no more than 'it is possible to construct an object that *appears* just like' the Penrose drawing (my emphasis). This is different from saying that it *is* the object drawn.The triangle could only exist in the walk-round sense I have described, in a world where our rules of dimensionality and continuity do not apply. Of course, the reason artists interest themselves in these structures (and here I agree with Dr French that the Penrose object is not a particularly exciting example) is that they represent visually the concept of ambiguity which is at the core of so much poetry. We seem to find poetic ambiguity, where images exist on a number of levels of reality at once, though, much easier to accept than visual ambiguity. I anticipate that computer artists, however, will continue to find this a rich vein to explore.

Chris French further objects to my point that impossible triangles had to be invented and that they did not exist until comparatively recently. He counters by reminding me of Hogarth's 18th Century 'Fishing' drawing where the artist takes such extreme liberties with perspective that a flock of sheep gets bigger as it recedes into the distance, an innsign is affixed to two apparently widely-spaced buildings at once, and a lady leans out of a window to light the pipe of a man standing on a hill which, if the perspective were correct, is too far away to make this possible. He claims that this drawing is, in essence, no different from the Penrose triangle but predates it by 200 years. The Hogarth drawing and examples of Dr French's own interesting work in the genre, can be seen in his controversial article in *Page 44;* the Computer Arts Society Quarterly for April 1980, (Figure 1 being a typical example).

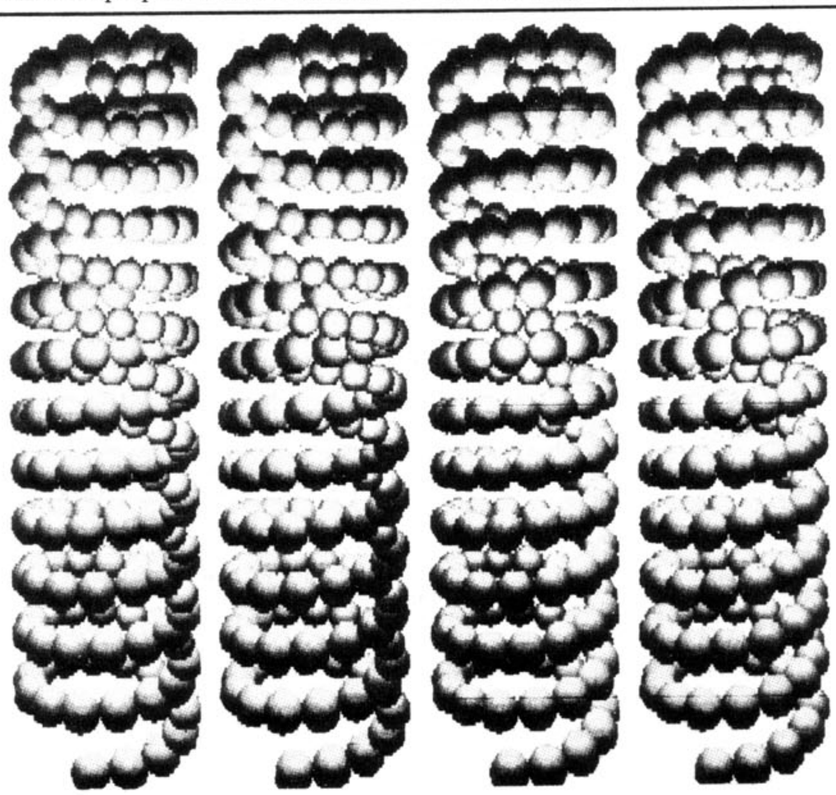

Figure 1

This is the way the world ends

I am writing these notes just after the successful completion of the Columbia Space Shuttle flight, but before a definitive explanation has been given of the computer failure which caused its two day postponement just nine minutes away from launch time. Tentatively, it has been announced that the reason was a breakdown of communications between the five onboard computers which monitor and control the Shuttle's performance. Apparently, four of these machines were programmed by the Big company and the other back-up machine, by a Small company. The trouble arose because the Big programs were sending their messages to the Small one a fraction of a second before it was ready to receive them. Originally, the TV pundits were blaming the Small company for this lapse, pointing out (in ways which suggested that the Big company's PR department were extremely prompt with their press releases), that the fault could only have been in the Small company's work because the Big company's work had been tested in the simulator and anyway, the Big company did not make mistakes of this nature. 16 ▶

and similarly for triple and higher multiples of abundance. The smallest doubly abundant number is 120. s(120) = 240. There are numbers for which $s(n) > k.n$ for any value of k, that is, numbers of more than any given multiple of abundance.
For example
$s(n!) \geq n(1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \ldots 1/n)$ and the sum in brackets can be made arbitrarily large by increasing n.

Is there an n such that s(n) = k.n for each integer k?

Abundant odd numbers are not so rare as odd perfect numbers and you may care to look for the first few. As n increases not only are some numbers increasingly abundant, but an increasing proportion of numbers are abundant, given that there is an infinite number of numbers such as 20 and 70 which are abundant but not the multiple of any abundant number, and so start a new progression of abundant numbers – their multiples. From this it might be expected that the average ratio s(n)/n increases with n. It does not. Apparently there are enough deficient numbers to keep the average of s(n)/n in check, for it tends to a modest limit.

Many problems in probabilities, combinatorics and number theory require high precision multi-length computation, usually in integers. This is beyond the normal double-length mode of large machines, but there are packages available for most mainframes. Now that many people interested in these subjects are using 8-bit micros I would like to have for publication details of any packages for multi-length arithmetic on such machines.

Date	p	m_p	Author	Computer
30/ 1/1952	521	157	Robinson	SWAC
30/ 1/1952	607	183	Robinson	SWAC
25/ 6/1952	1279	386	Robinson	SWAC
7/10/1952	2203	664	Robinson	SWAC
9/10/1952	2281	687	Robinson	SWAC
8/ 9/1957	3217	969	Riesel	BESK
3/11/1961	4253	1281	Hurwitz & Selfridge	IBM 7090
3/11/1961	4423	1332	Hurwitz & Selfridge	IBM 7090
11/ 5/1963	9689	2917	Gillies	Illiac II
16/ 5/1963	9941	2993	Gillies	Illiac II
2/ 6/1963	11213	3376	Gillies	Illiac II
4/ 3/1971	19937	6002	Tuckerman	IBM360/91
30/10/1978	21701	6533	Nickel & Noll	CDC CYBER-174
9/ 2/1979	23209	6987	Noll	CDC CYBER-174
8/ 4/1979	44497	13395	Nelson & Slowinski	CRAY 1

m_p is the number of digits in the decimal representation of M_p

Table 2 Prime Mersenne numbers

Surprise

Try your intuition on this little program. It adds up – well you can see to what it adds up – then it evaluates a simple function of the sum. What do you think the result will be? If you and your computer have a few moments to spare, run the program for a fairly large value of N, say more than a million. I will print the best explanation of this surpriselet received by Monday 13 July. Address your contribution to ωμεγα at 13 Mansfield Street, London WIM 0BP.

```
A = 0
For I = 1 TO N
A = A + I * INT (N/I)
NEXT I
A = SQR (12 * A/(N * N + N))
PRINT A
```

COMPUTER ART *continued*

No-one in the computing industry can feel much satisfaction when learning of such an elementary, but potentially disastrous error, but I confess to letting out a small cheer when it turned out that it was the Big program that was wrong and not the Small one.

Bad though the Shuttle problem was, it pales into insignificance when one thinks what might happen if five similarly configured computers are controlling our nuclear retaliation devices. We can imagine a scenario in which a radar scanner detects what it believes to be a Soviet missile, passes this information to one computer which asks the four others to verify the result. They disagree with the original diagnosis and tell the first computer so, but, because they are mistiming their replies, the information is not received. What happens? Because of the need for secrecy we would not, of course, be told the answer, but will be assured that such a thing could not happen – presumably by the same analysts who told NASA, up to nine minutes before the launch, that all their five computers were working in synchronisation. There is no-one who believes more fervently than I in the power of simulation, and the need to simulate as many of the likely problems in a complex operation as possible. But not everything can be simulated and not all problems can be anticipated. We can only hope that those in charge of all our destinies have realised this.

Caxton, thou shouldst be living at this hour

Like almost every other industry, printing and publishing is being revolutionised by the introduction of computing techniques. Many of the changes are probably for the better, but one represents a very severe regression and that is the introduction by MIT press of an absolutely appalling computerised type and layout system for many of their new books. One such is *Artificial Intelligence: An MIT Perspective* by Winston and Brown (Eds). This otherwise excellent book is marred for me by the use of this ugly system which seems to discard all that has been learned about typography and layout since books were first printed. The publishers say that the format has been adopted to reduce the cost of publishing and to shorten the gap between writing and final publication. No-one has asked for it, but my advice is forget it. Better still, read Donald Knuth's new book *TEX and META FONT: New Directions in Typesetting*. Digital Press, 1979.